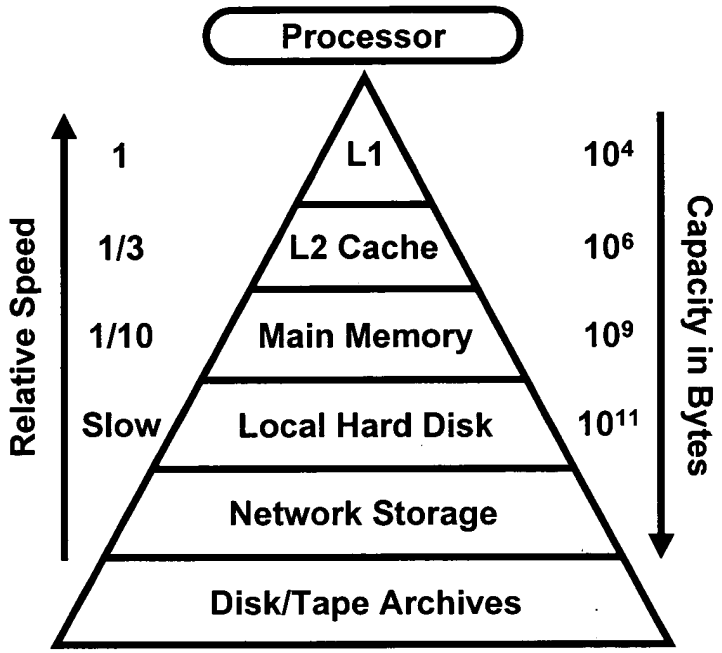
Processor
L1
L2 Cache
Main Memory
Local Hard Disk
Network Storage
Disk/Tape Archives
Relative Speed
1
1/3
1/10
Slow
Capacity in Bytes
10^4
10^6
10^9
10^11

FIG. 1

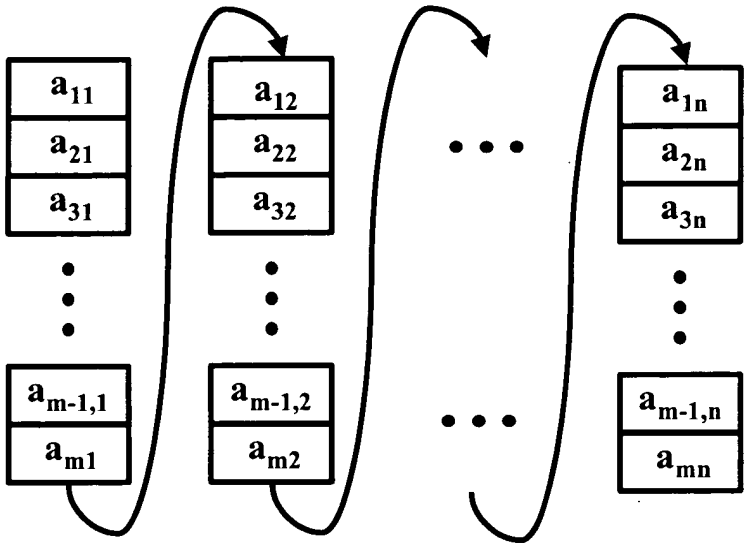

FIG. 2

Row-oriented algorithm:

```
nrows = 32768; ncolumns = 1024;
A = rand(nrows, ncolumns);
B = zeros(size(A));
v = rand(1, ncolumns);
tic, for j = 1:nrows
   B(j,:) = A(j,:).* v;
end, toc
```

Column-oriented algorithm:

```
nrows = 1024; ncolumns = 32768;
A = rand(nrows, ncolumns);
B = zeros(size(A));
v = rand(nrows, 1);
tic, for j = 1:ncolumns
   B(:,j) = A(:,j).* v;
end, toc
```

FIG. 3

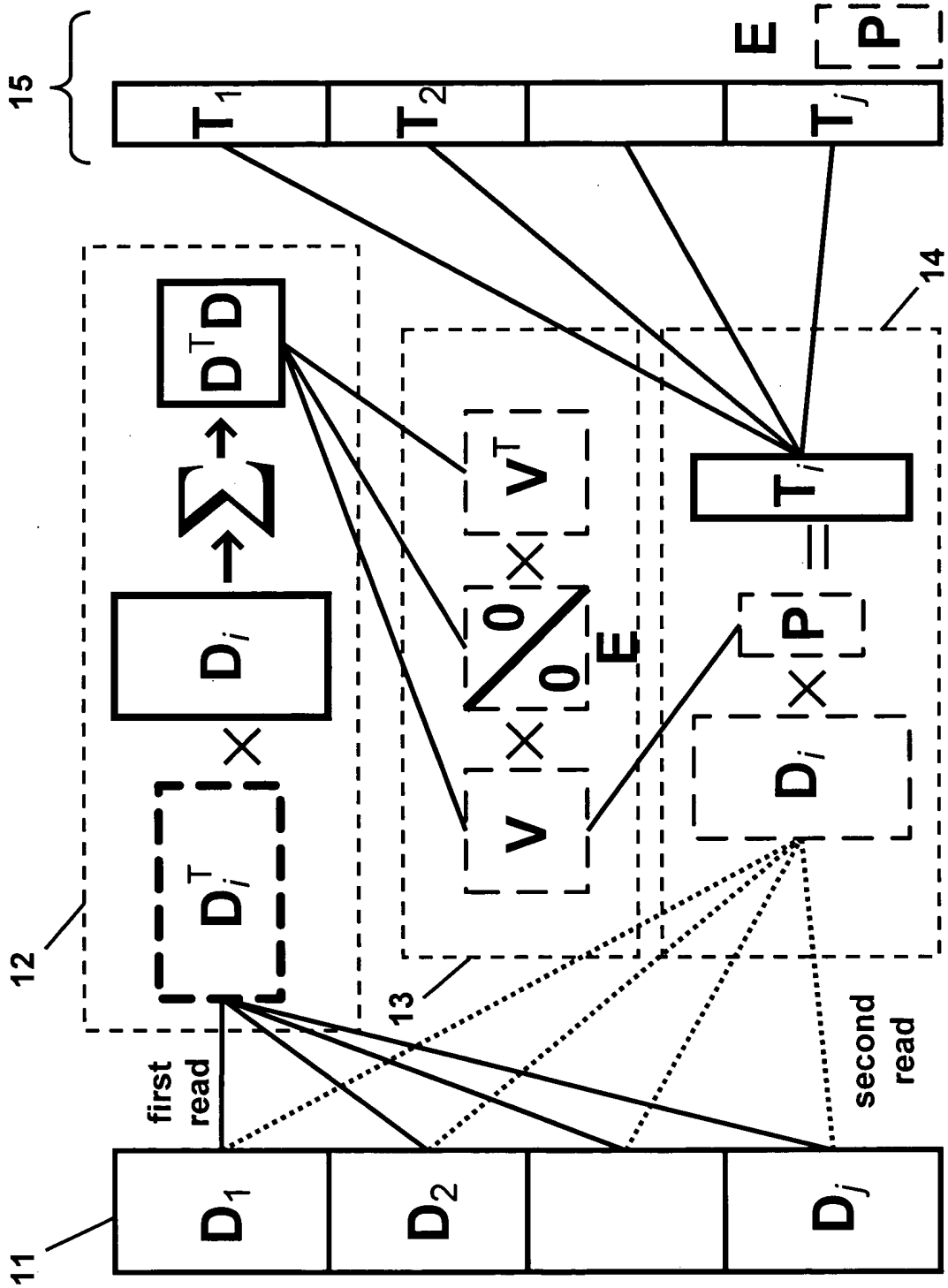
15
E
P
T_1
T_2
T_j
14
D^TD
V^T
T_i
D_i
0
0
E
P
V
D_i
12
D_i^T
13
first read
second read
D_1
D_2
D_j
11

FIG. 4

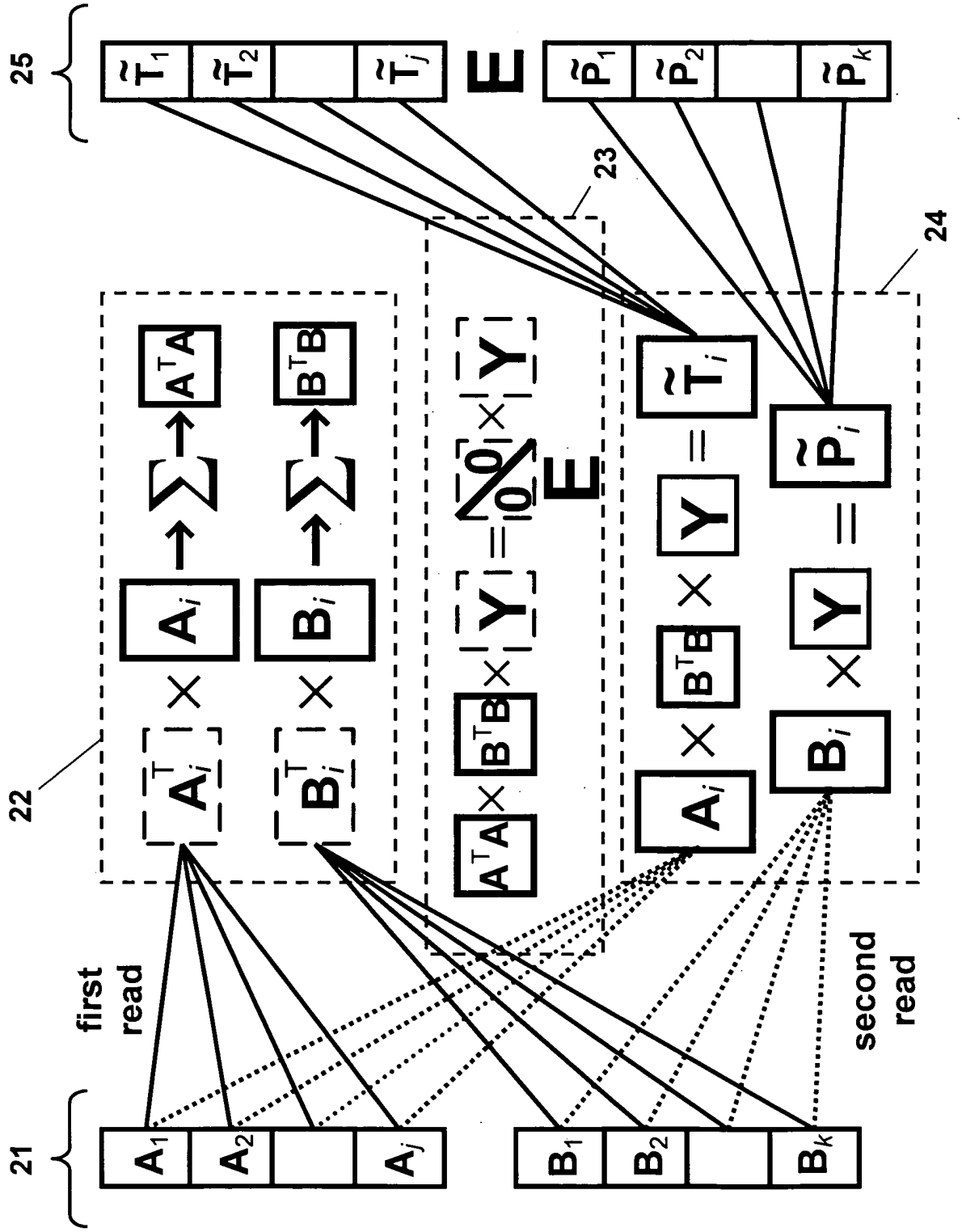

FIG. 5

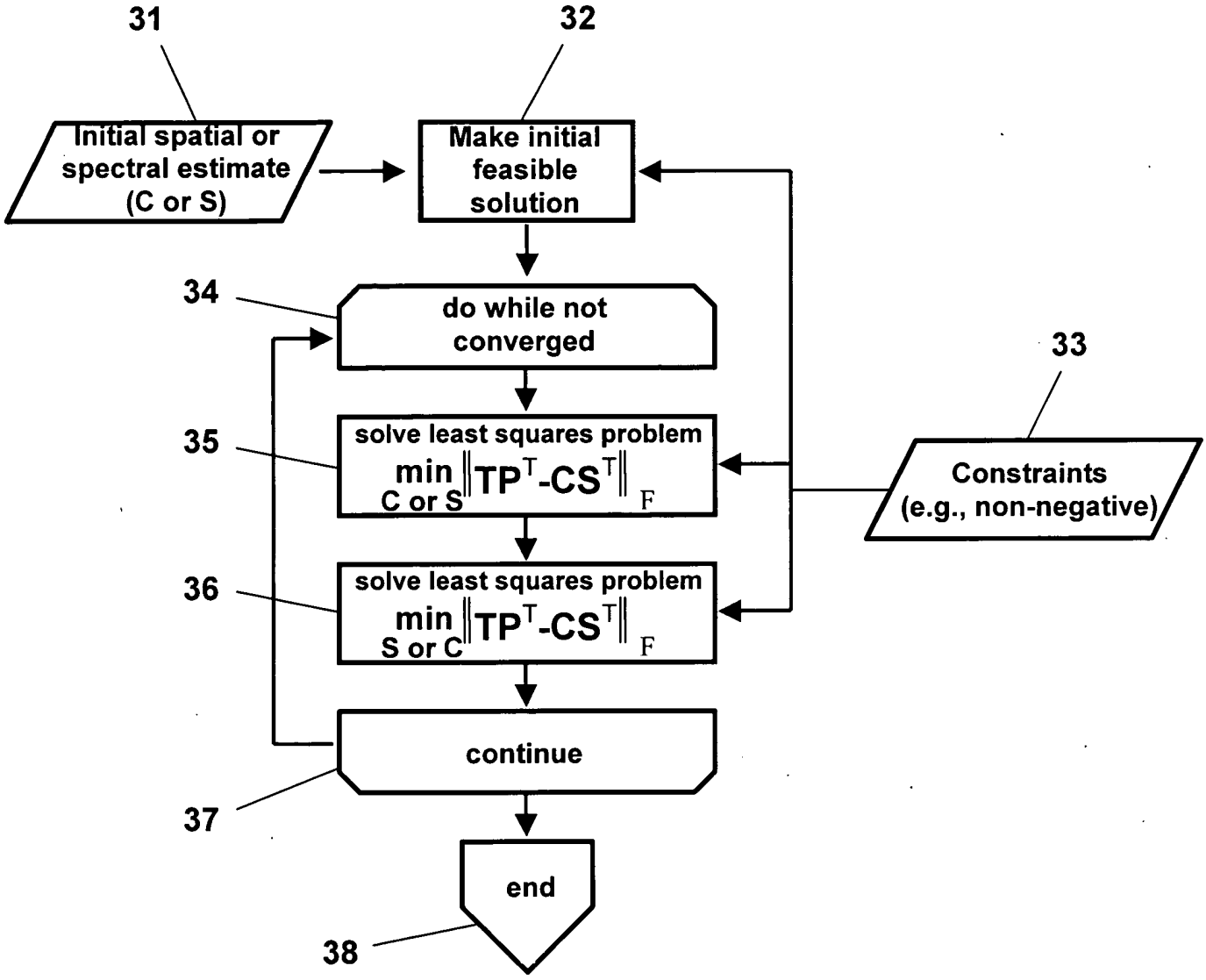
31
32
Initial spatial or spectral estimate (C or S)
Make initial feasible solution
34
do while not converged
33
35
solve least squares problem
$\min_{C \text{ or } S} \|TP^T - CS^T\|_F$
Constraints (e.g., non-negative)
36
solve least squares problem
$\min_{S \text{ or } C} \|TP^T - CS^T\|_F$
continue
37
end
38

FIG. 6

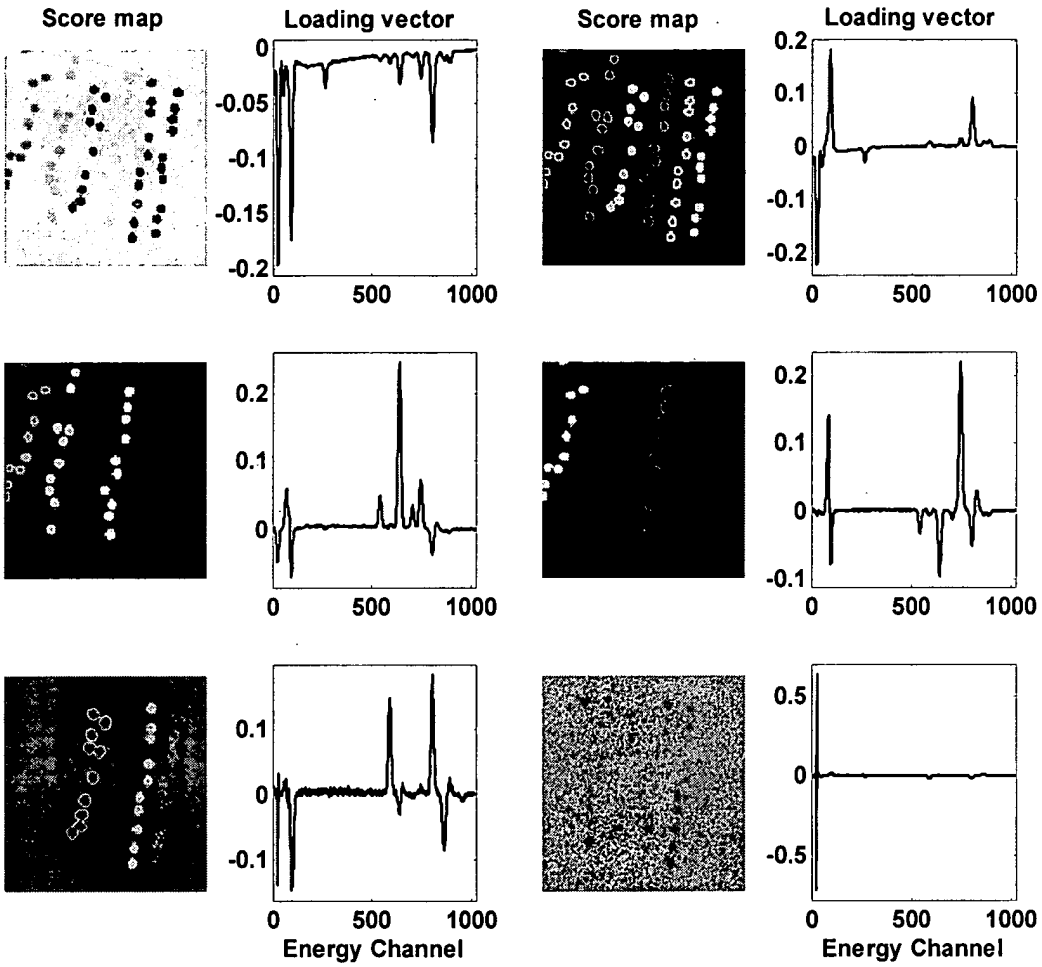
Score map
Loading vector
Score map
Loading vector
0
-0.05
-0.1
-0.15
-0.2
0.2
0.1
0
-0.1
-0.2
0.5
-0.5
0
500
1000
Energy Channel

FIG. 7

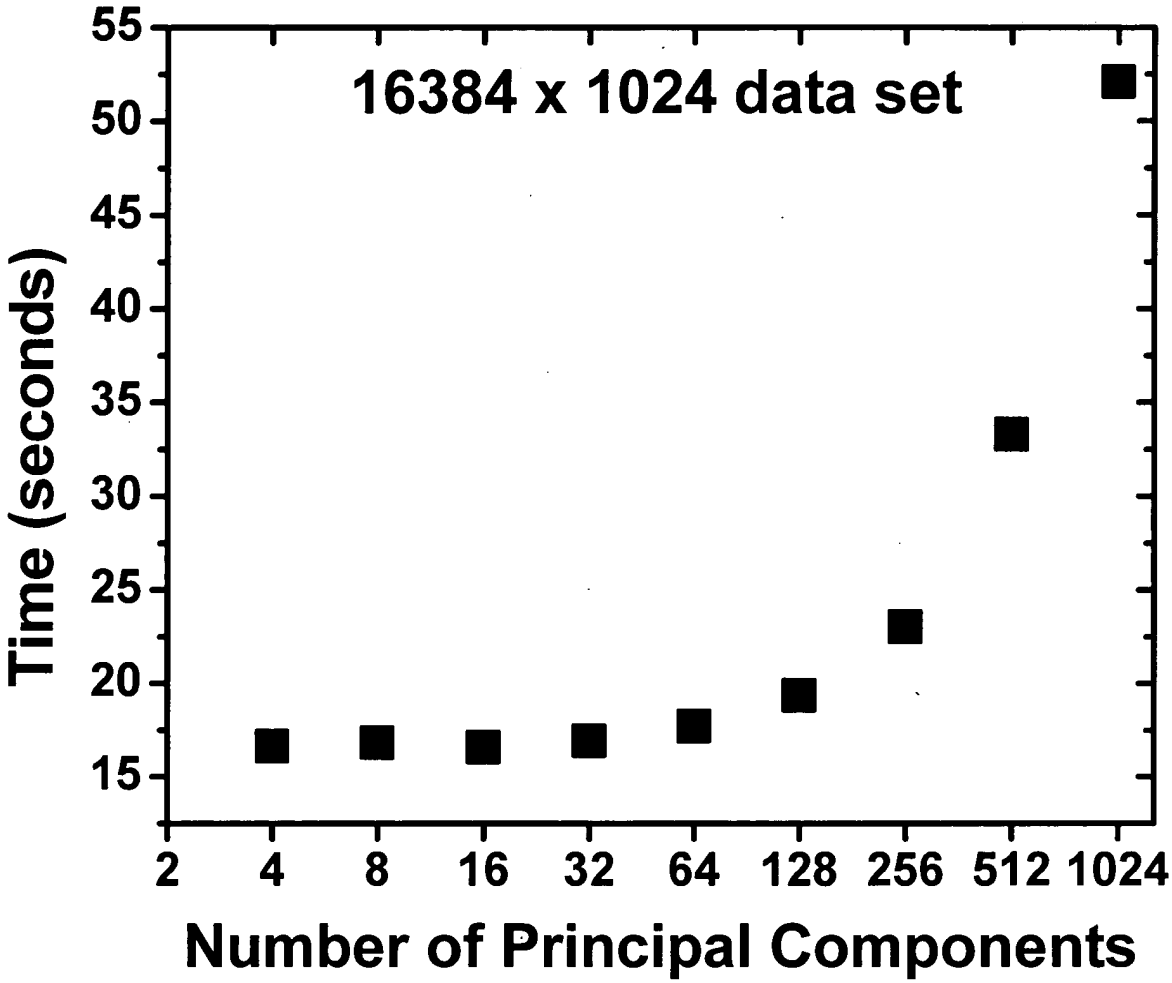
16384 x 1024 data set
Time (seconds)
55
50
45
40
35
30
25
20
15
2
4
8
16
32
64
128
256
512
1024
Number of Principal Components

FIG. 8

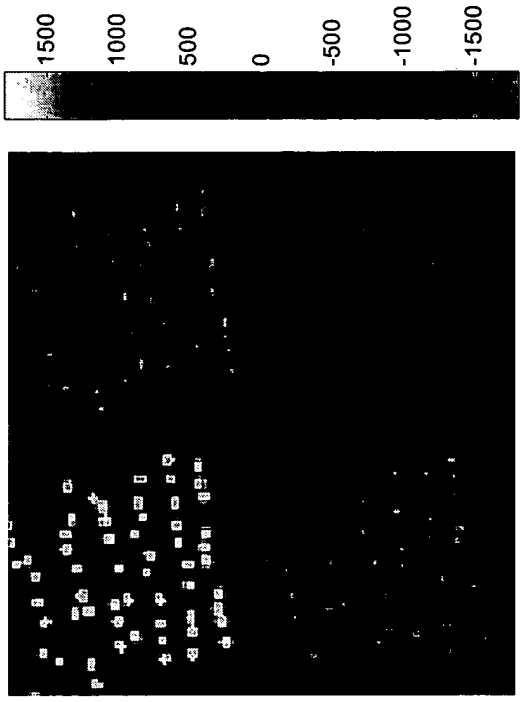

FIG. 9B

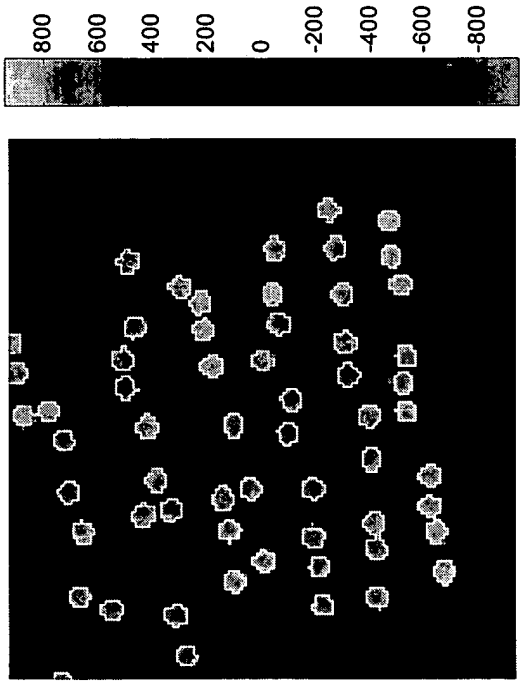

FIG. 9A

BEST AVAILABLE COPY

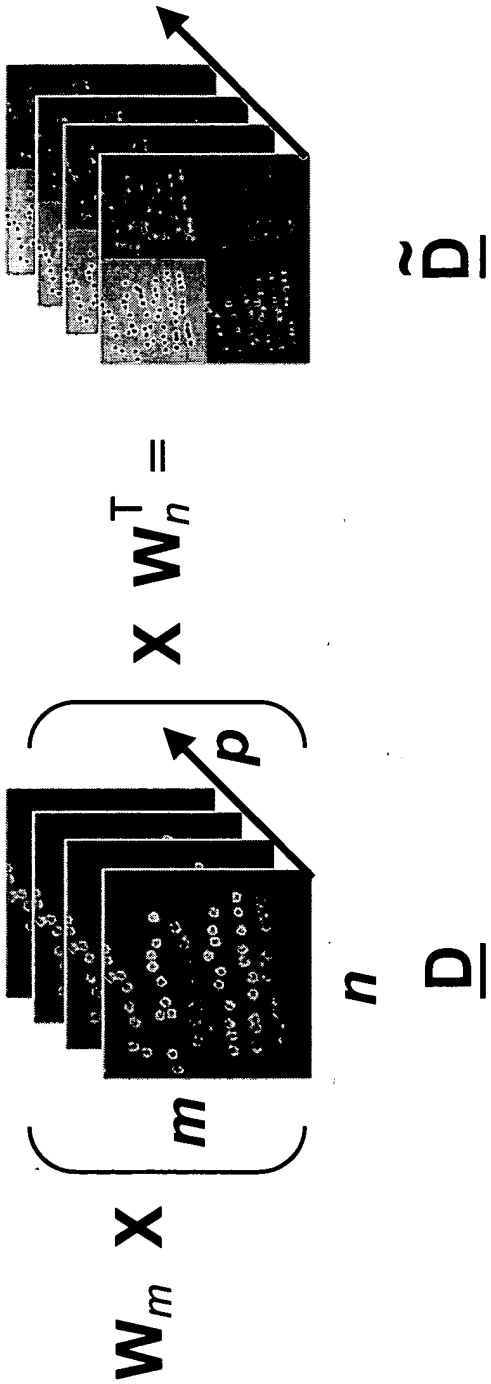

FIG. 10

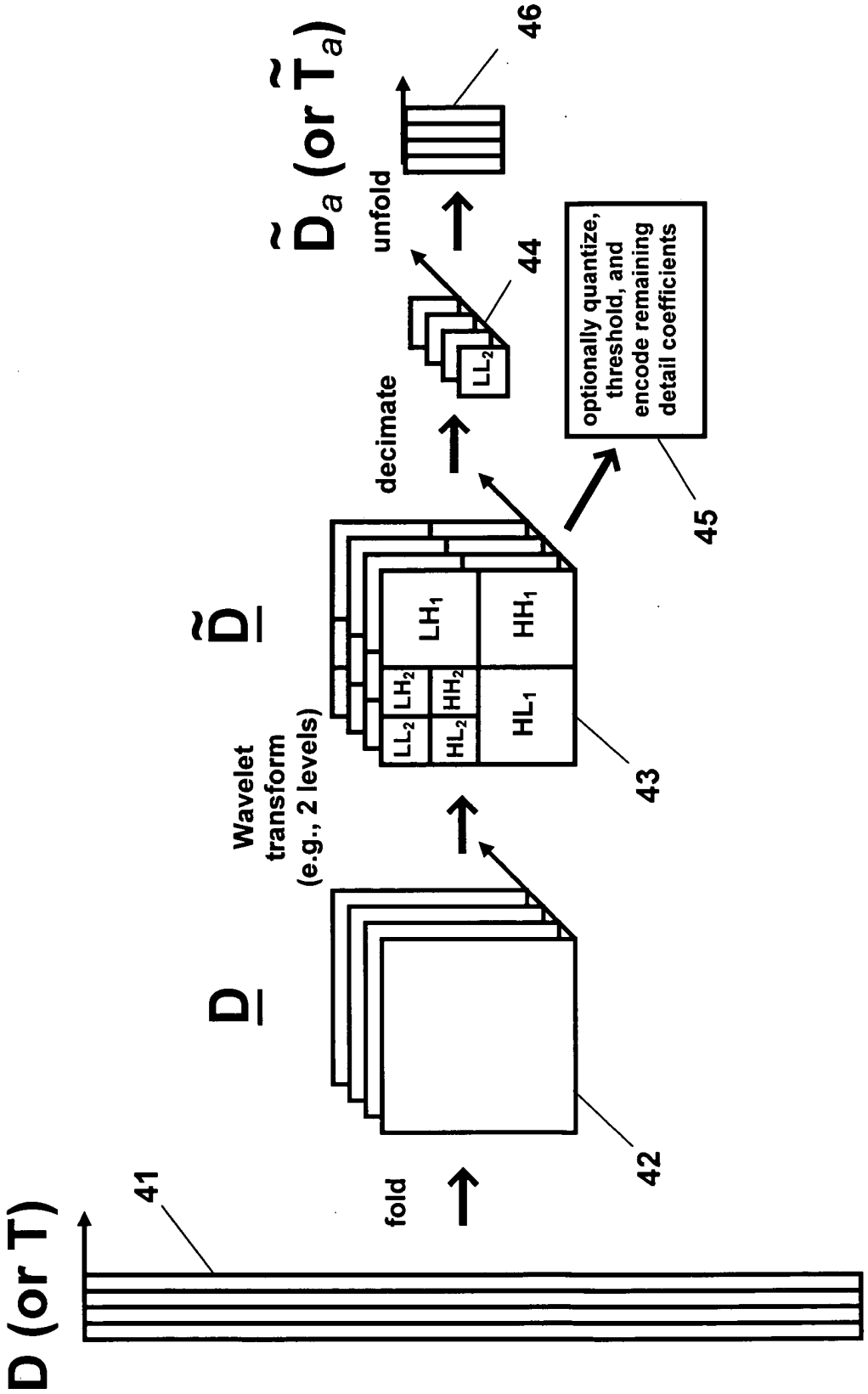
D (or T)
41
fold
42
D
Wavelet transform (e.g., 2 levels)
43
LH1
HH1
LH2
HH2
LL2
HL2
HL1
D
decimate
44
LL2
optionally quantize, threshold, and encode remaining detail coefficients
45
unfold
46
D_a (or T_a)

FIG. 11

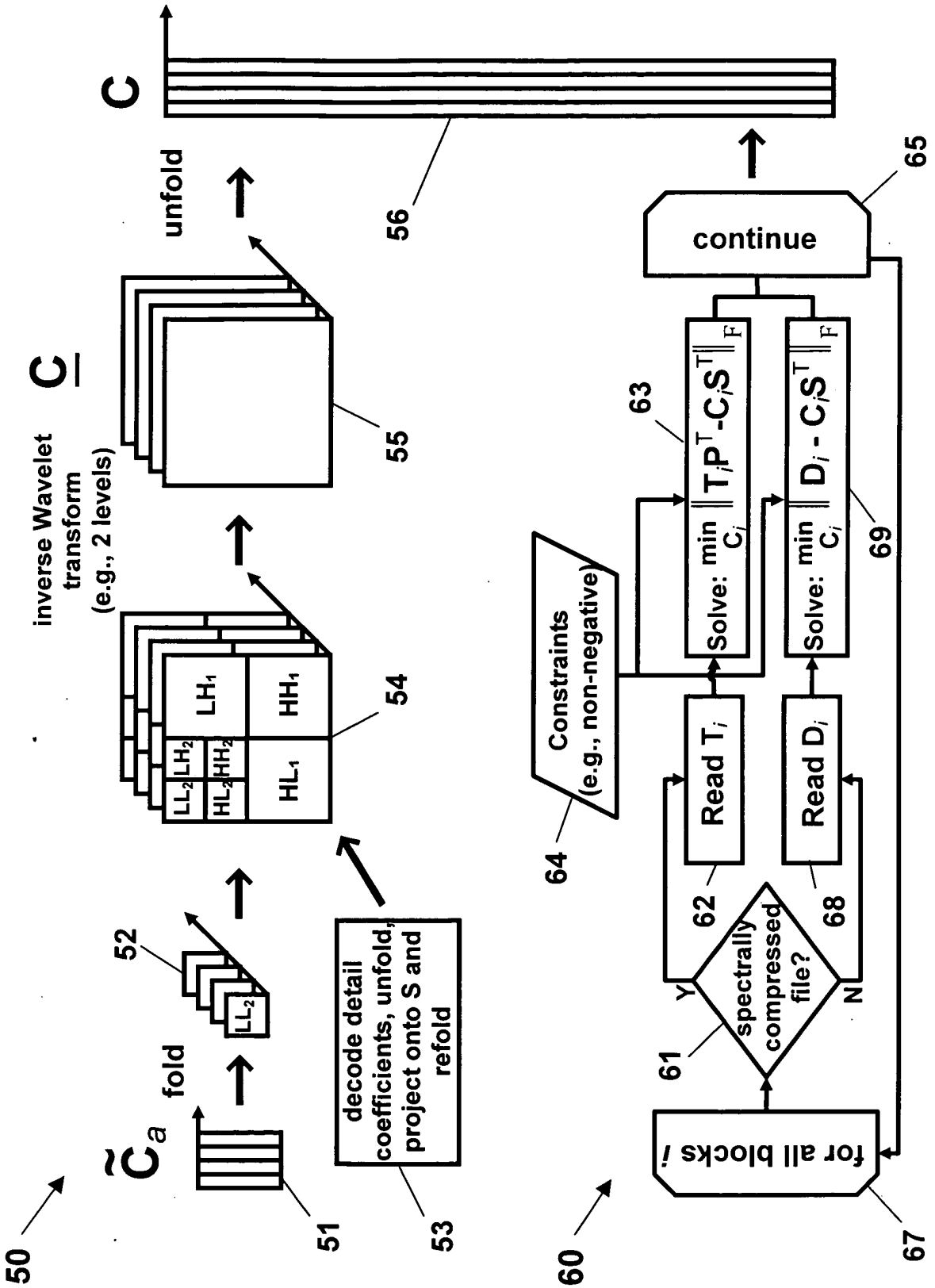
50
$\tilde{C}_a$
fold
52
LL_2
51
decode detail coefficients, unfold, project onto S and refold
53
inverse Wavelet transform (e.g., 2 levels)
$\underline{C}$
LL_2 LH_2 HL_2 HH_2 LH_1 HH_1 HL_1
54
55
unfold
C
56
60
for all blocks i
67
spectrally compressed file?
61
Y
N
Read T_i
62
Read D_i
68
Constraints (e.g., non-negative)
64
Solve: $\min_{C_i} \| T_i P^T - C_i S^T \|_F$
63
Solve: $\min_{C_i} \| D_i - C_i S^T \|_F$
69
continue
65

FIG. 12

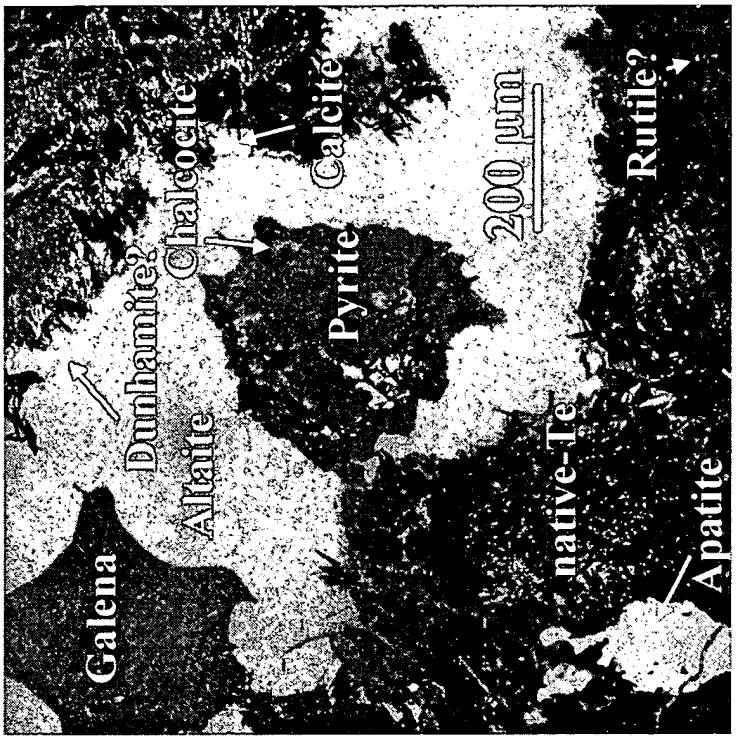

FIG. 13B

FIG. 13A

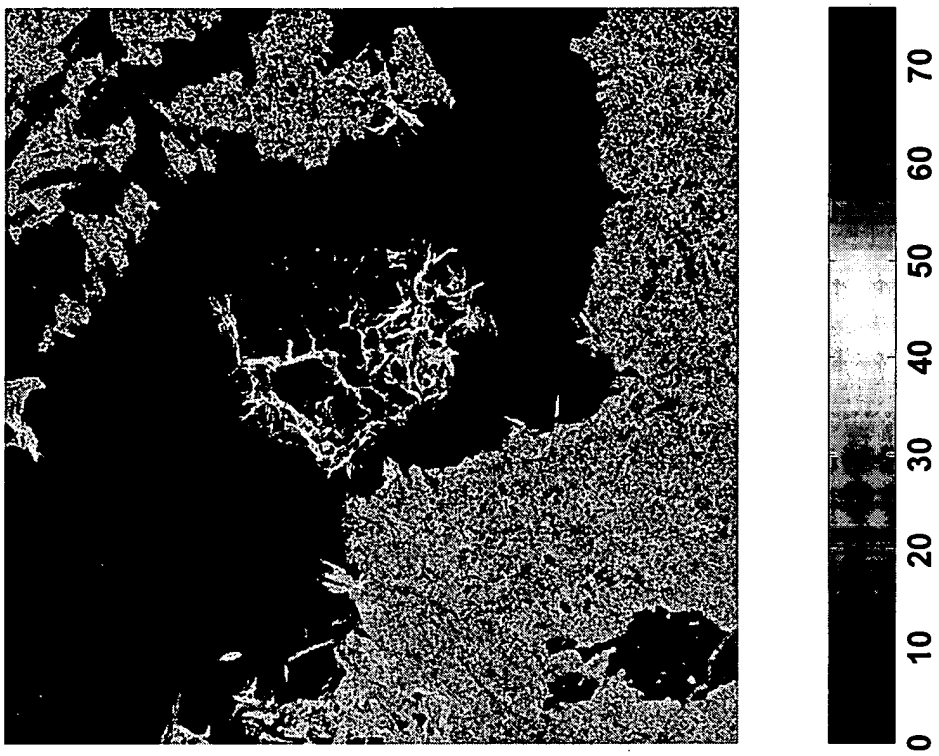

FIG. 13D

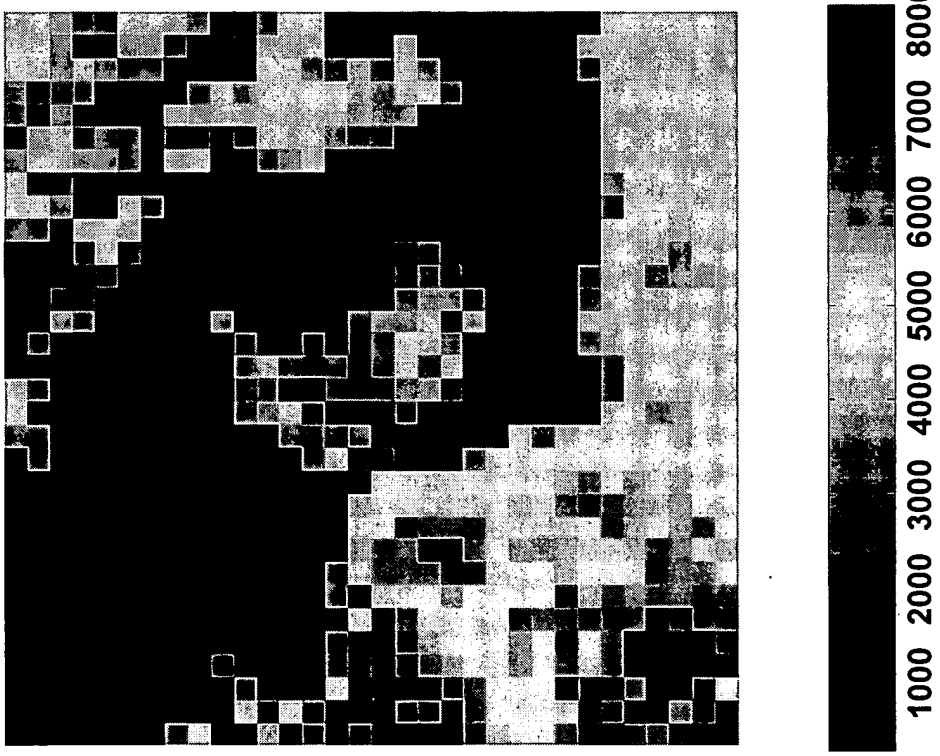

FIG. 13C

BEST AVAILABLE COPY

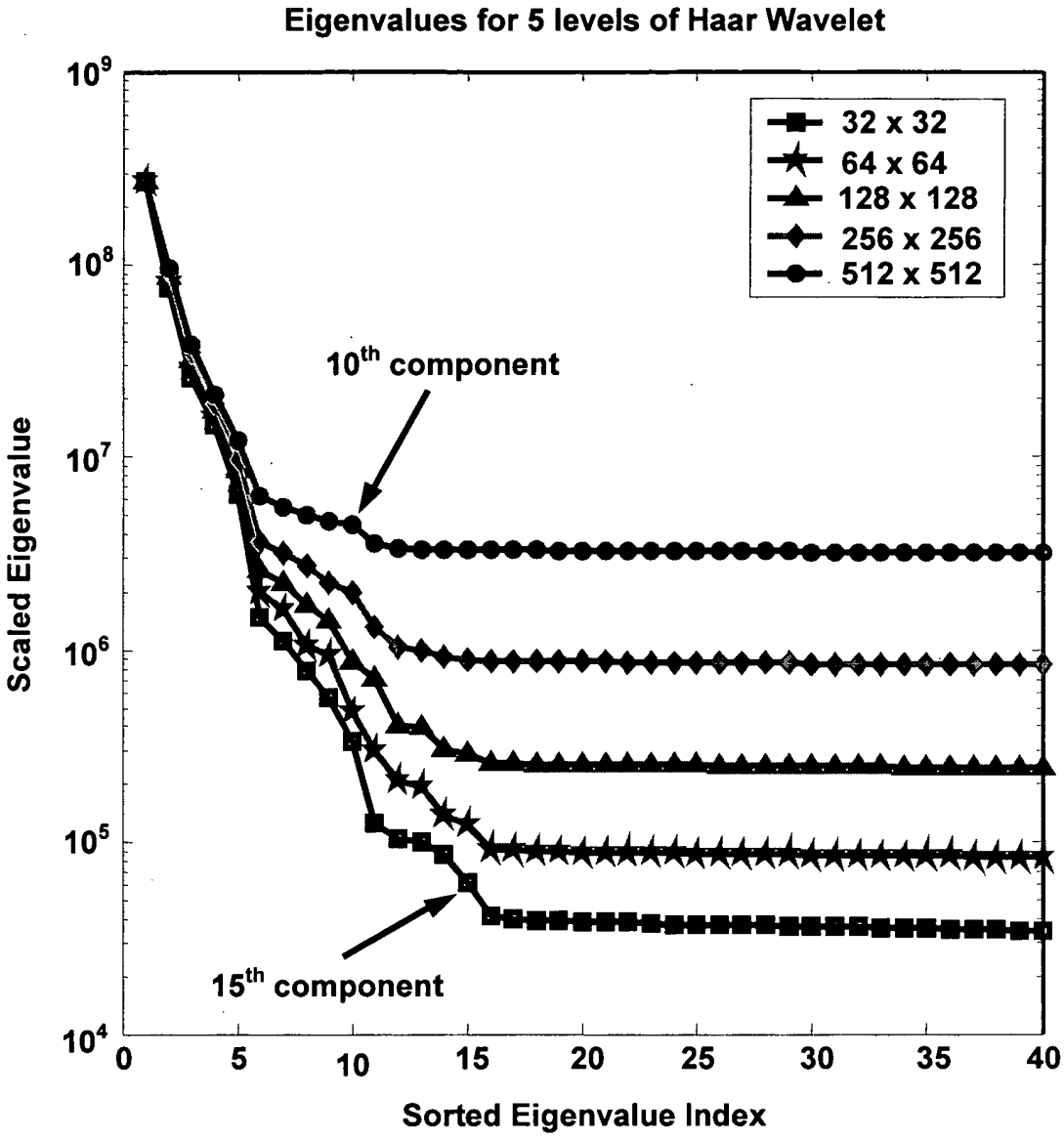
Eigenvalues for 5 levels of Haar Wavelet
Scaled Eigenvalue
Sorted Eigenvalue Index
32 x 32
64 x 64
128 x 128
256 x 256
512 x 512
10th component
15th component
10^9
10^8
10^7
10^6
10^5
10^4
0
5
10
15
20
25
30
35
40

FIG. 14

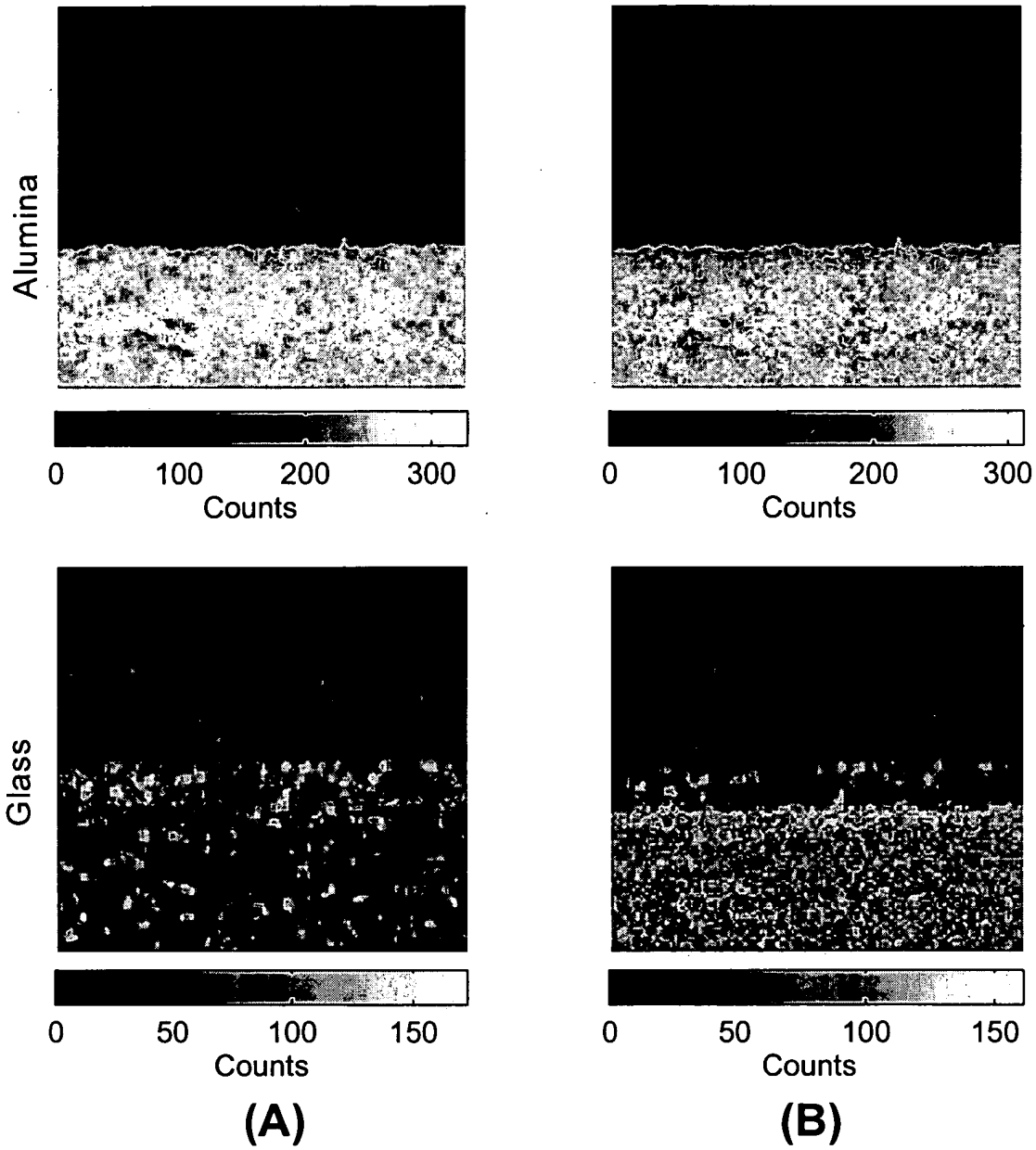

FIG. 15

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